Remarks

Telephonic Interview

The undersigned participated in a telephonic interview with Examiner James Pilkington and SPE Richard Riley on August 2, 2007 as follows:

Regarding the rejection of Claims 1 and 3-9 under 35 U.S.C. § 112, first paragraph, the rejection is primarily directed to the limitation "disengaging elements" recited in Claim 1. The Examiners were concerned that "disengaging" is not accurate or does not properly describe the element in question. For example, the Examiners asked what was being disengaged. The undersigned explained that the operation of the "disengaging elements" is well known in the prior art. For example, disengaging the other ratio steps of the same group as described by the prior art we cited in the reply dated April 27, 2007 (United States Patent No. 7,093,511 (*Norum et al.*)).

Claim 1 recites: "said shift finger and disengaging elements are arranged to operate the gearshift rails," The undersigned explained that the operation recited in the claim for the disengagement elements is well known to displace the "non-selected" shift rails to disengage shift forks as required for the selected gear ratio etc.

Regarding the rejection of Claims 1 and 3-9 under 35 U.S.C. §103(a), the Examiners suggested amending Claim 1 as follows to more positively recite the bearing arrangement: "wherein said bearing arrangement ~~is formed by~~ comprises protruding rods ~~operatively arranged to~~ that support the gearshift rails." The Examiners indicated that the preceding amendment would emphasize the novelty of the bearing arrangement and would help distinguish the bearing arrangement from the prior art. Applicants have amended Claim 1 as suggested above.

The undersigned and the Examiners also discussed the "drive unit" aspect of the rejection and there was a general agreement that the fork (36) is not a drive unit.

The Rejection of Claims 1 and 3-9 Under 35 U.S.C. § 112

The Examiner has rejected Claims 1 and 3-9 under 35 U.S.C. § 112, first paragraph as failing to comply with the enablement requirement. Specifically, the Examiner states that how the shift finger and disengaging elements operate the gearshift rails is critical or essential to the practice of the invention, which description the Examiner asserted is not disclosed in the specification, the claims, or the drawings. In addition, the Examiner stated that how the shift finger shifts, how the disengaging members disengage, and with what the shift finger and disengaging member communicate with on the shift rails to move them are not disclosed.

Applicants respectfully traverse the rejection.

In accordance with the telephonic interview noted above and the papers filed on November 29, 2006 and April 27, 2007, Applicants respectfully submit that the operation of the "disengaging elements" is well known in the prior art. For example, disengaging the other ratio steps of the same group as described by the prior art cited in the November 29 reply (United States Patent No. 7,093,511 (Norum et al.)). In the interest of brevity, Applicants have not repeated in full the arguments noted above in this paper.

Claim 1 recites: "said shift finger and disengaging elements are arranged to operate the gearshift rails," Applicants respectfully submit that the operation recited in the claim for the disengagement elements is well known. That is, it is well know to displace the "non-selected" shift rails to disengage shift forks as required to engage the selected gear ratio. Alternately stated, one skilled in the art would have no trouble understanding the operation recited in Claim 1.

MPEP 2163.02 states: "An objective standard for determining compliance with the written description requirement is, "does the description clearly allow persons of ordinary skill in the art to recognize that he or she invented what is claimed." *In re Gosteli*, 872 F.2d 1008, 1012, 10 USPQ2d 1614, 1618 (Fed. Cir. 1989). Under *Vas-Cath, Inc. v. Mahurkar*, 935 F.2d 1555, 1563-64, 19 USPQ2d 1111, 1117 (Fed. Cir. 1991), to satisfy the written description requirement, an applicant must convey with reasonable clarity to those skilled in the art that, as of the filing date sought, he or she was in possession of the invention, and that the invention, in that context,

is whatever is now claimed. The test for sufficiency of support in a parent application is whether the disclosure of the application relied upon "reasonably conveys to the artisan that the inventor had possession at that time of the later claimed subject matter." *Ralston Purina Co. v. Far-Mar-Co., Inc.*, 772 F.2d 1570, 1575, 227 USPQ 177, 179 (Fed. Cir. 1985) (quoting *In re Kaslow*, 707 F.2d 1366, 1375, 217 USPQ 1089, 1096 (Fed. Cir. 1983))."

At least a portion of the novelty of the claimed invention lies outside the well-known operation of the shift finger and disengaging elements with respect to the gearshift rails. For example, one point of novelty recited in Claim 1 is the bearing arrangement that includes protruding rods that support the gearshift rails. That is, the bearing arrangement supports the gearshift rails, but the operation of those rails is as known in the art. Alternately stated, the claimed invention does not include a new or novel operation of the gearshift rails.

"A patent need not teach, **and preferably omits**, what is well known in the art." *In re Buchner*, 929 F.2d 660, 661, 18 U.S.P.Q.2d 1331, 1332 (Fed. Cir. 1991) (emphasis added) (citations omitted); M.P.E.P. § 2164.01. Applicants courteously submit that the patent to *Norum et al.* is part of the general knowledge in the relevant field of art, in particular regarding how a shift finger and disengaging members operate gearshift rails, how shift fingers shift, what the shift finger and disengaging member communicate with on the shift rails to move them. Applicants' disclosure need not read as a treatise on subject matter which is already in the public domain and within the purview of one skilled in the art. *Norum et al.* substantiate that the alleged deficient disclosure is already in the public domain, and consequently, Applicants' disclosure need not dwell on such details.

Applicants performed an internet search and found a myriad of references that teach the well-known operation of shift finger and disengaging elements with respect to the gearshift rails. For example, the site "HowStuffWorks" includes a clear and illustrated explanation of the preceding operation. A copy of the article has been attached to the Appendix.

For all the reasons noted above, Applicants courteously request that the rejection be removed.

Rejection of Claims 1 and 3-9 Under 35 U.S.C. § 103

The Examiner has rejected Claims 1 and 3-9 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 4,911,031 (Yoshimura et al.), in view of U.S. Patent No. 6,082,215 (Jerwick).

Applicants respectfully traverse the rejection.

The cited references do not teach the drive unit recited in Claim 1

Claim 1 recites a drive unit that drives a selector shaft. That is, the drive unit originates a force and applies the force to drive the selector shaft. The Examiner cited shift fork (36) in Jerwick as teaching the drive unit. In the telephonic interview of August 2, the Examiner agreed that the shift fork in Jerwick is not a drive unit. For example, Jerwick teaches that the shift fork receives force, that is, reacts to force applied by another device: "shift forks **36** are moved forward and rearward causing the clutch collars **38** to move forward and rearward." (col. 3, lines 42-44). That is, forks 36 do not generate a drive force and apply the drive force to a selector shaft. Applicants presented further arguments regarding the shift fork in the November 29 and April 27 papers. In the interest of brevity, these arguments are reaffirmed, but not repeated in this paper.

The cited references do not teach the bearing arrangement recited in Claim 1

Claim 1 was amended as follows per the telephonic interview of August 2: "a bearing arrangement operatively arranged to support gearshift rails...wherein said bearing arrangement comprises protruding rods that support the gearshift rails." The amendment, suggested by the Examiners, more clearly distinguishes the bearing arrangement in Claim 1 from the teachings in Jerwick.

Jerwick discloses integral front and rear support members **80** and **82**, respectively. However, these members are different in structure and function that the rods recited in Claim 1. Specifically, Claim 1 recites protruding rods that support the gearshift rails. That is, the gearshift rails rest upon protrusions. In contrast, members **80** and **82** include cylindrical bores **90** and **92**, respectively. A cylindrical shift rail **96** is supported in bores **90** and **92**, respectively. (col. 3,

line 65 through col. 4, line 9). Thus, instead of resting a rail upon a protrusion, such as a rod, Jerwick teaches the very different arrangement of inserting the rail into an opening. That is, the shift rail must be inserted through bores **90** and **92** prior to installing top cover **50** within the transmission.

The cited references do not teach the single selector shaft recited in Claim 1

Applicants presented arguments regarding the selector shaft in the replies of November 29 and April 27 and for the sake of brevity, reaffirm, but do not repeat these arguments in this paper.

For all the reasons noted above, the cited references fail to teach, suggest, or motivate all the elements of Claim 1. Therefore, Claim 1 is patentable over the cited references. Claims 3-9, dependent upon Claim 1, enjoy the same distinction with respect to the cited references.

Applicants courteously request that the rejection be removed.

Conclusion

Applicants respectfully submit that the application is now in condition for allowance, which action is courteously requested. The Examiner is invited and encouraged to contact the undersigned if such contact will facilitate an efficient examination and allowance of the application.

Respectfully submitted,

/C. Paul Maliszewski/

C. Paul Maliszewski
Registration No. 51,990
Simpson & Simpson PLLC
5555 Main Street
Williamsville, NY 14221
Phone: (716) 626-1564
Fax: (716) 626-0366

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CPM/

Appendix

howstuffworks
It's good to know.

How Manual Transmissions Work

by Marshall Brain

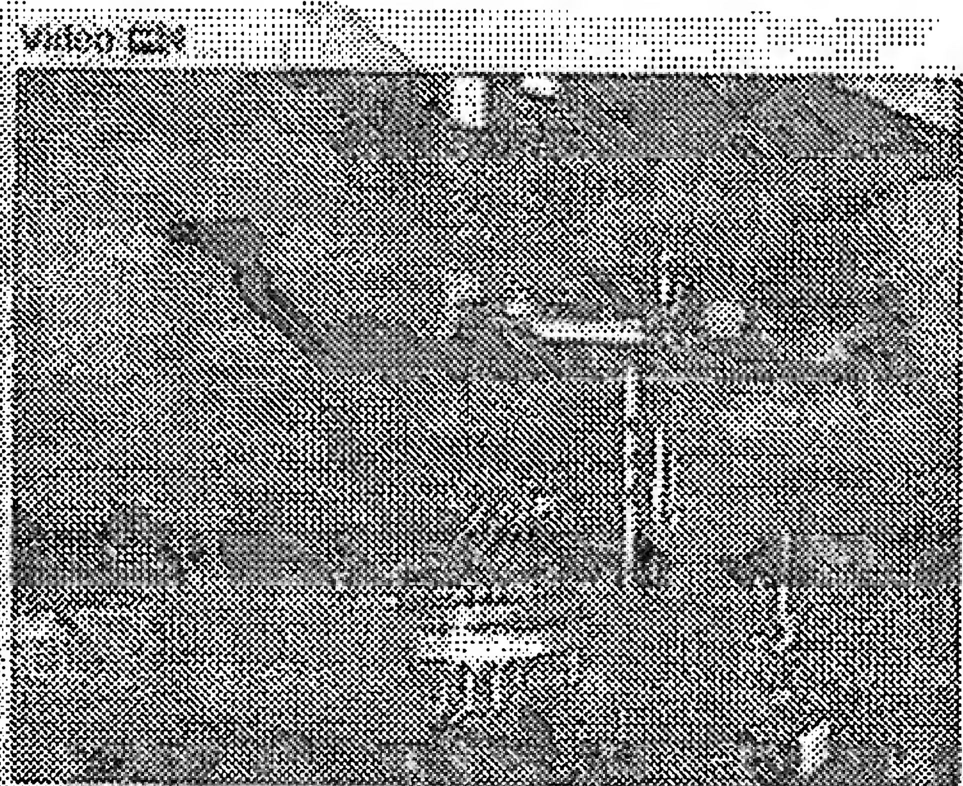
Introduction to How Manual Transmissions Work


Photo courtesy DaimlerChrysler
Mercedes-Benz C-class, 6-speed manual transmission

If you drive a stick-shift car, then you may have several questions floating in your head:

- How does the funny **"H" pattern** that I am moving this shift knob through have any relation to the gears inside the transmission? What is moving inside the transmission when I move the shifter?
- When I mess up and hear that horrible **grinding** sound, what is actually grinding?
- What would happen if I were to accidentally shift into **reverse** while I am speeding down the freeway? Would the entire transmission explode?

In this article, we'll answer all of these questions and more as we explore the interior of a manual transmission.

Video

How Manual Transmissions Work - Manual transmissions allow car and truck drivers to change gears and thus maintain the best performance. See how manual transmissions work in this video from HowStuffWorks.

Cars need transmissions because of the physics of the gasoline engine. First, any engine has a **redline** -- a maximum rpm value above which the engine cannot go without exploding. Second, if you have read How Horsepower Works, then you know that engines have narrow rpm ranges where horsepower and torque are at their maximum. For example, an engine might produce its maximum horsepower at 5,500 rpm. The transmission allows the gear ratio between the engine and the drive wheels to change as the car speeds up and slows down. You shift gears so the engine can stay below the redline and near the rpm band of its best performance.

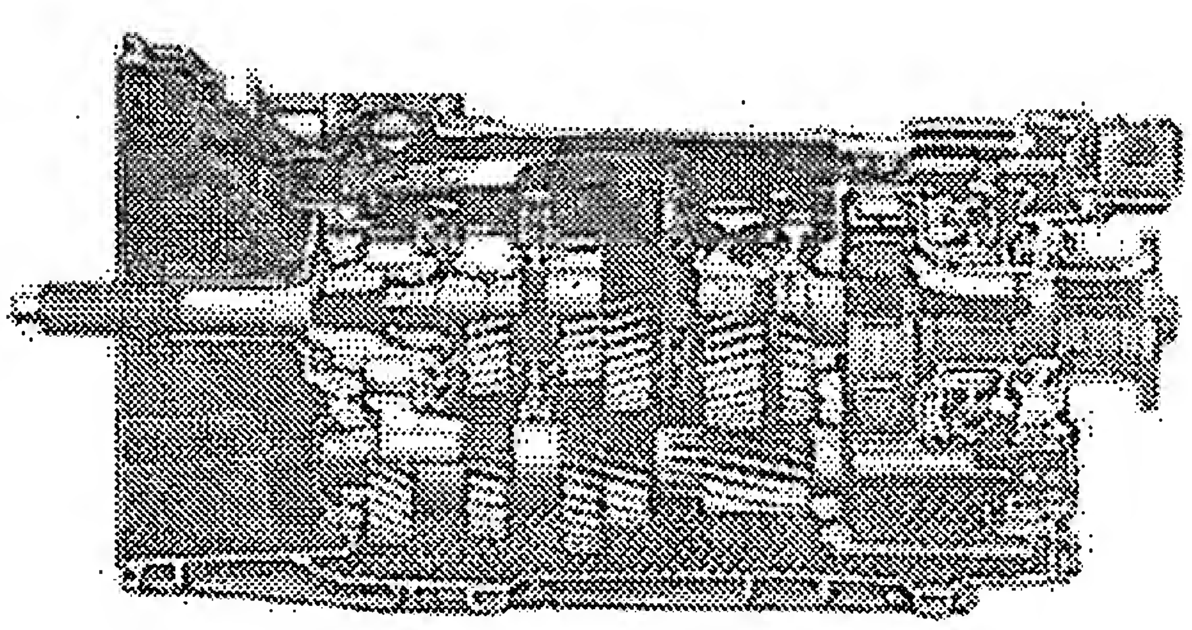
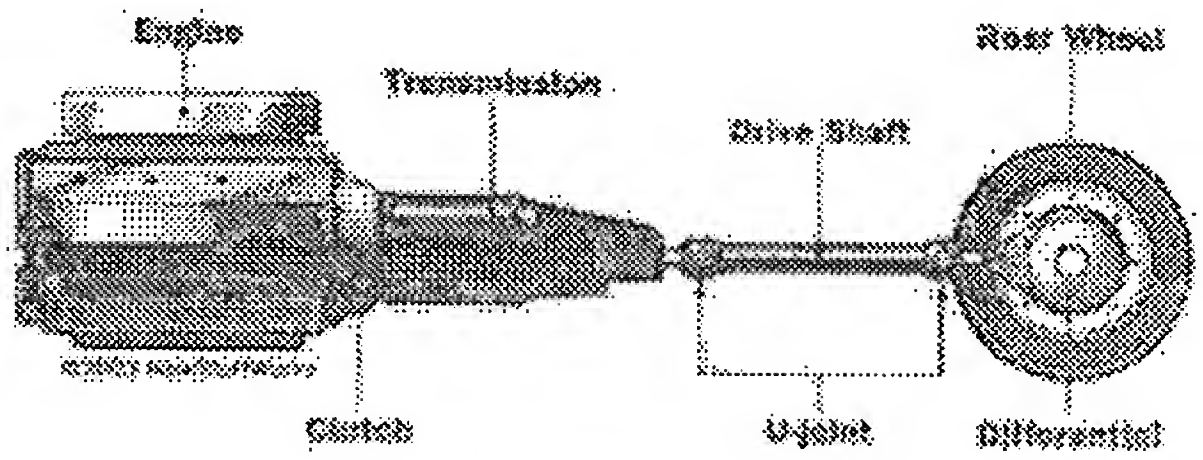


Photo courtesy DaimlerChrysler
Mercedes-Benz Actros, manual transmission

Ideally, the transmission would be so flexible in its ratios that the engine could always run at its single,

best-performance rpm value. That is the idea behind the continuously variable transmission (CVT).

A CVT has a nearly infinite range of gear ratios. In the past, CVTs could not compete with four-speed and five-speed transmissions in terms of cost, size and reliability, so you didn't see them in production automobiles. These days, improvements in design have made CVTs more common. The Toyota Prius is a hybrid car that uses a CVT.



The transmission is connected to the engine through the clutch. The input shaft of the transmission therefore turns at the same rpm as the engine.

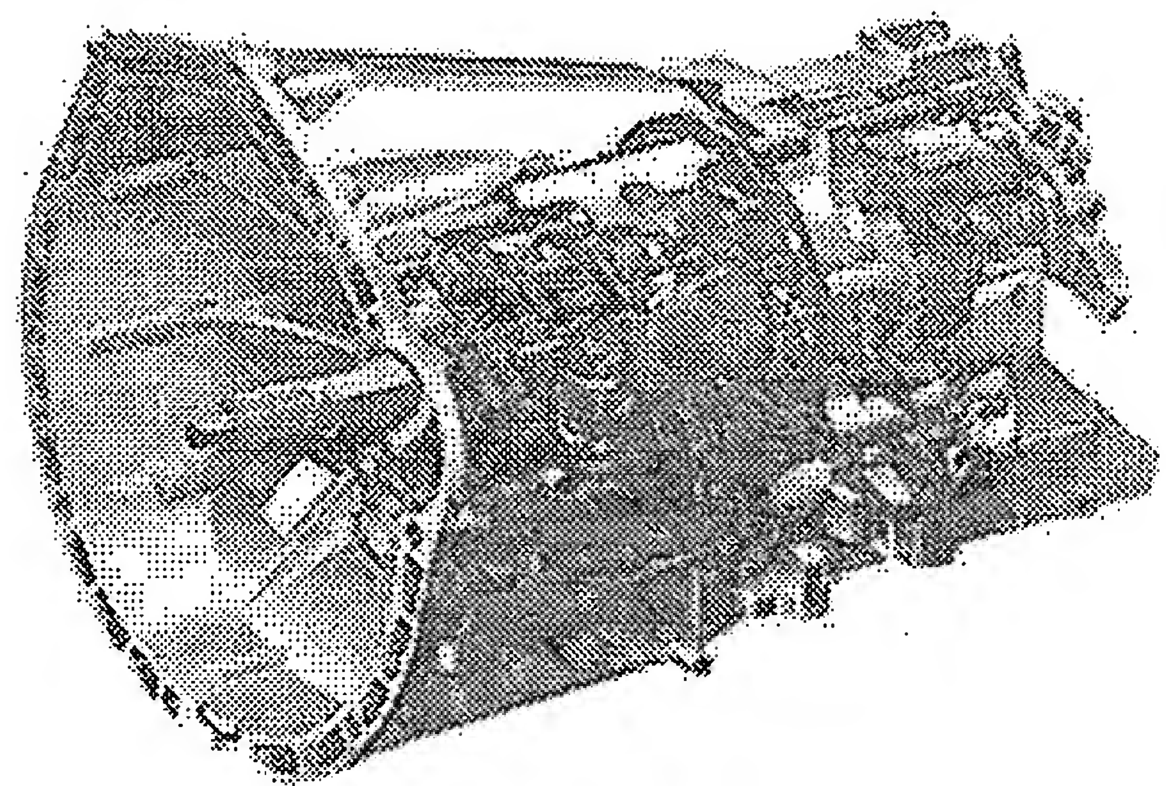


Photo courtesy DaimlerChrysler

Mercedes-Benz C-class sport coupe, six-speed manual transmission, graphic illustration

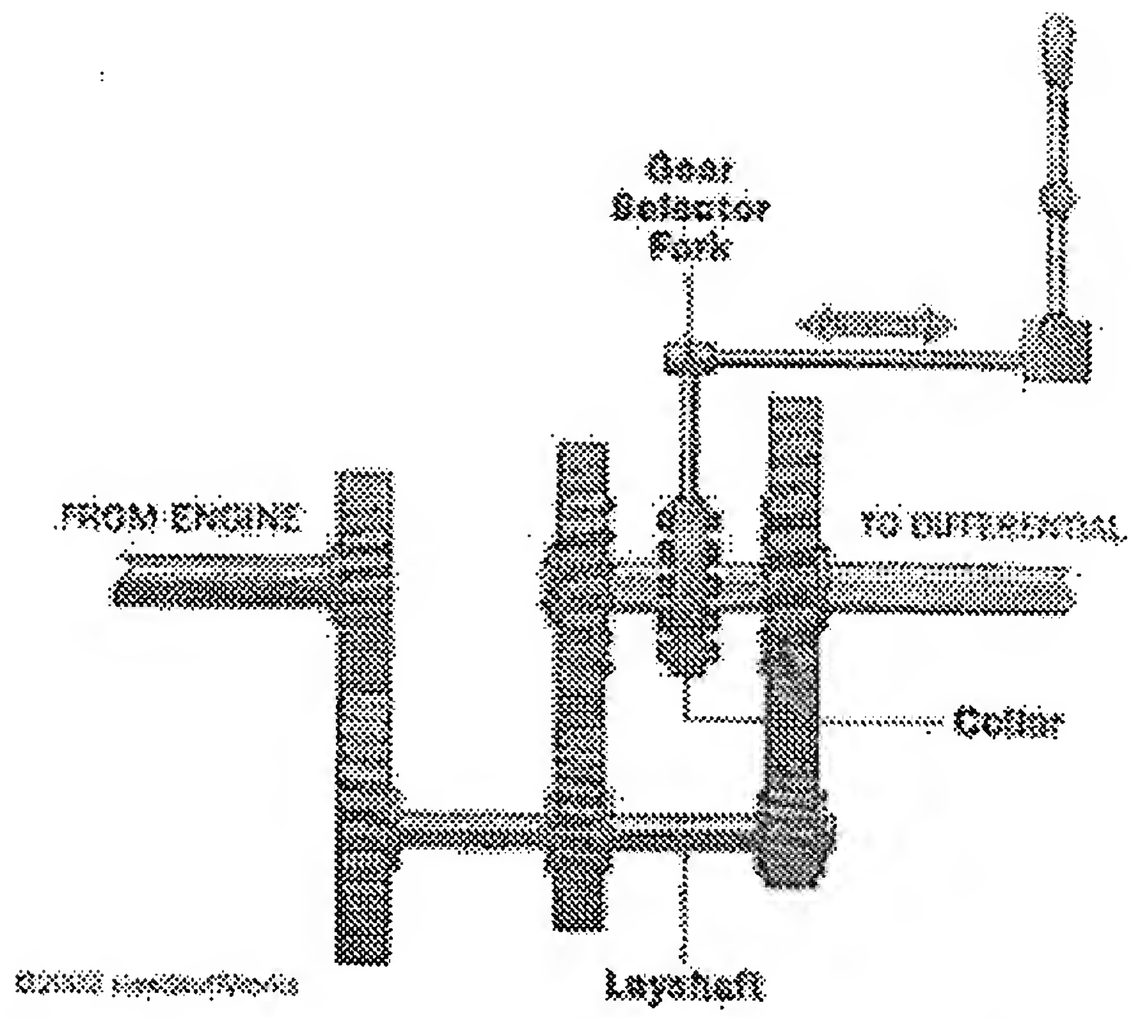
A five-speed transmission applies one of five different gear ratios to the input shaft to produce a different rpm value at the output shaft. Here are some typical gear ratios:

Gear	Ratio	RPM at Transmission Output Shaft with Engine at 3,000 rpm
1st	2.315:1	1,295
2nd	1.568:1	1,913
3rd	1.195:1	2,510
4th	1.000:1	3,000
5th	0.915:1	3,278

You can read How CVTs Work for even more information on how continuously variable transmissions work. Now let's look at a simple transmission.

A Very Simple Transmission

To understand the basic idea behind a standard transmission, the diagram below shows a very simple two-speed transmission in neutral.



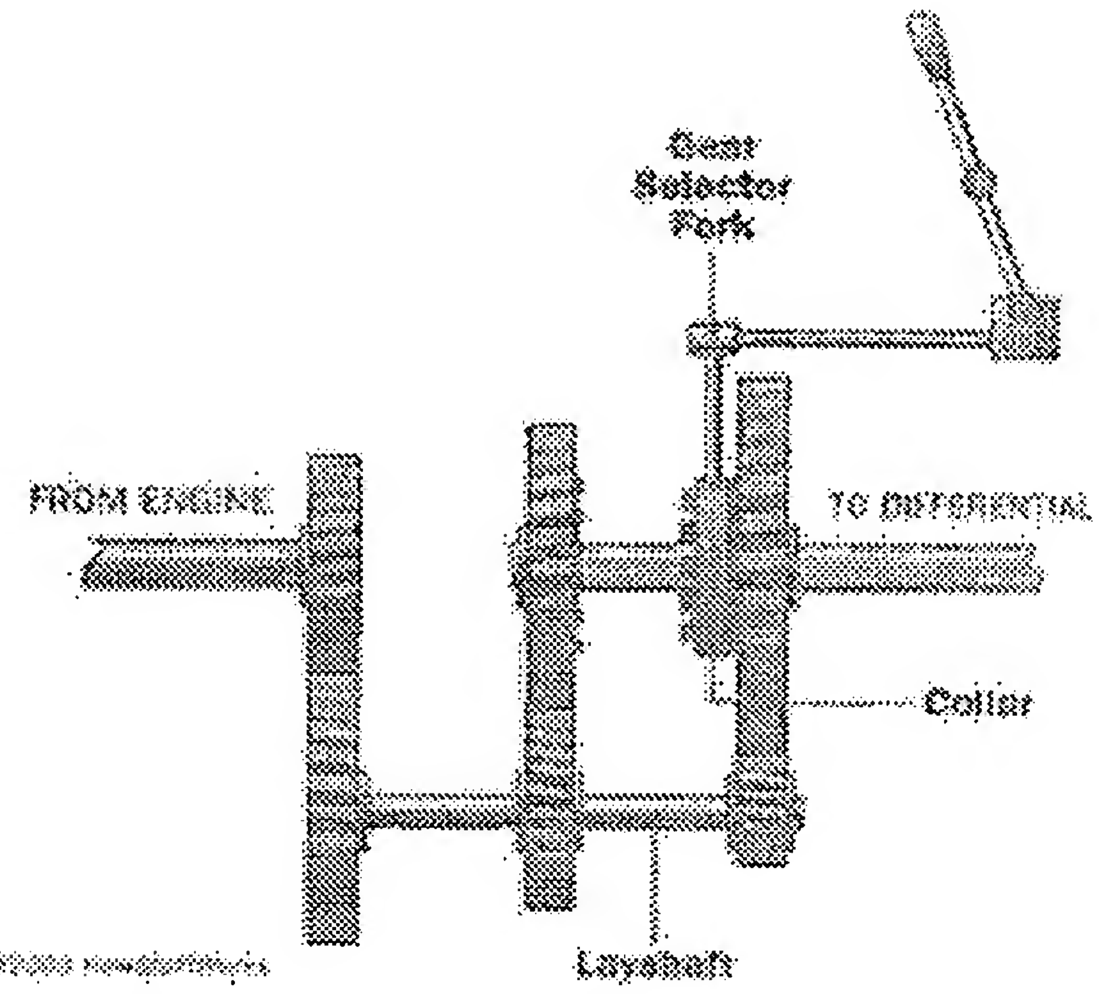
Let's look at each of the parts in this diagram to understand how they fit together:

- The green shaft comes from the engine through the clutch. The green shaft and green gear are connected as a single unit. (The clutch is a device that lets you connect and disconnect the engine and the transmission. When you push in the clutch pedal, the engine and the transmission are disconnected so the engine can run even if the car is standing still. When you release the clutch pedal, the engine and the green shaft are directly connected to one another. The green shaft and gear turn at the same rpm as the engine.)
- The red shaft and gears are called the **layshaft**. These are also connected as a single piece, so all of the gears on the layshaft and the layshaft itself spin as one unit. The green shaft and the red shaft are directly connected through their meshed gears so that if the green shaft is spinning, so is the red shaft. In this way, the layshaft receives its power directly from the engine whenever the clutch is engaged.
- The yellow shaft is a splined shaft that connects directly to the drive shaft through the differential to the drive wheels of the car. If the wheels are spinning, the yellow shaft is spinning.
- The blue gears ride on bearings, so they spin on the yellow shaft. If the engine is off but the car is coasting, the yellow shaft can turn inside the blue gears while the blue gears and the layshaft are motionless.
- The purpose of the **collar** is to connect one of the two blue gears to the yellow drive shaft. The collar is connected, through the splines, directly to the yellow shaft and spins with the yellow shaft. However, the collar can slide left or right along the yellow shaft to engage either of the blue gears. Teeth on the collar, called **dog teeth**, fit into holes on the sides of the blue gears to engage them.

Now, let's see what happens when you shift into first gear.

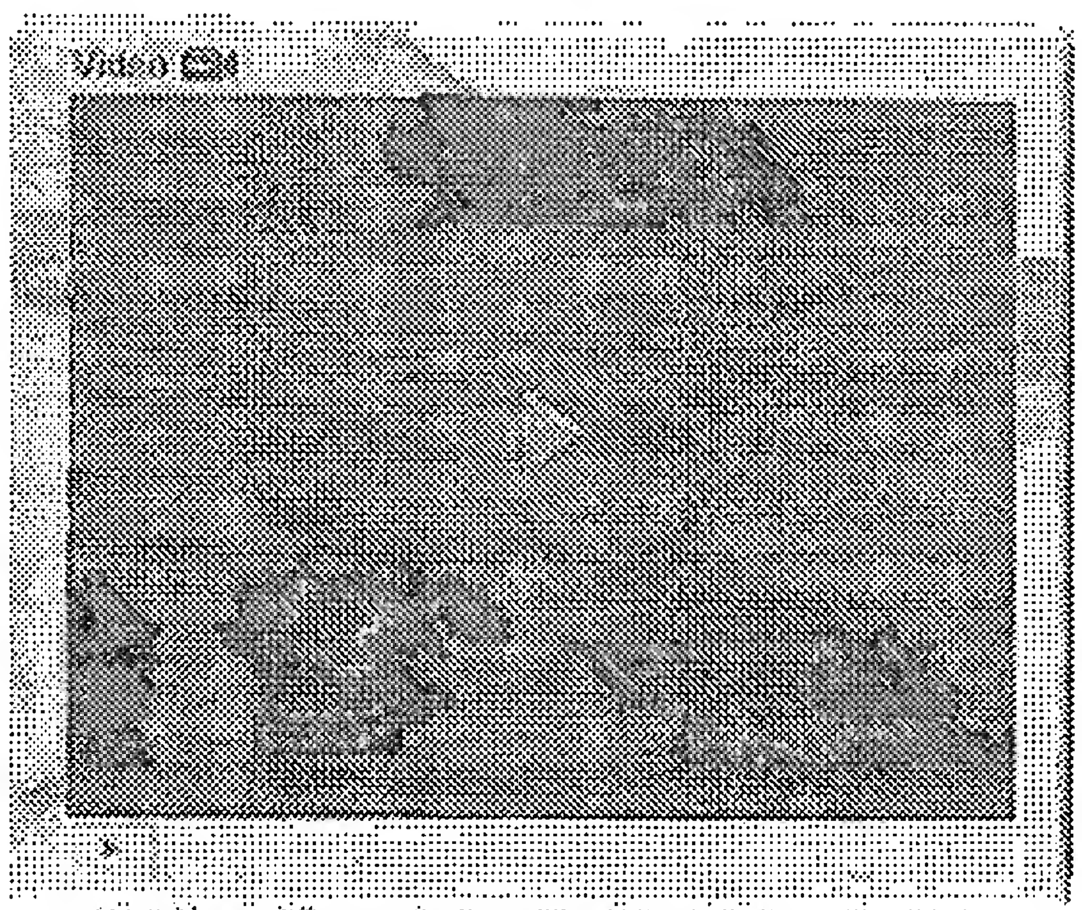
First Gear

The picture below shows how, when shifted into first gear, the collar engages the blue gear on the right:



In this picture, the green shaft from the engine turns the layshaft, which turns the blue gear on the right. This gear transmits its energy through the collar to drive the yellow drive shaft. Meanwhile, the blue gear on the left is turning, but it is freewheeling on its bearing so it has no effect on the yellow shaft.

When the collar is between the two gears (as shown in the first figure), the transmission is in neutral. Both of the blue gears freewheel on the yellow shaft at the different rates controlled by their ratios to the layshaft.



How Manual Transmissions Work: Installation - If a driver grinds the gears too many times while shifting, the transmission may become damaged. In this HowStuffWorks video, see how a mechanic installs a new manual transmission.

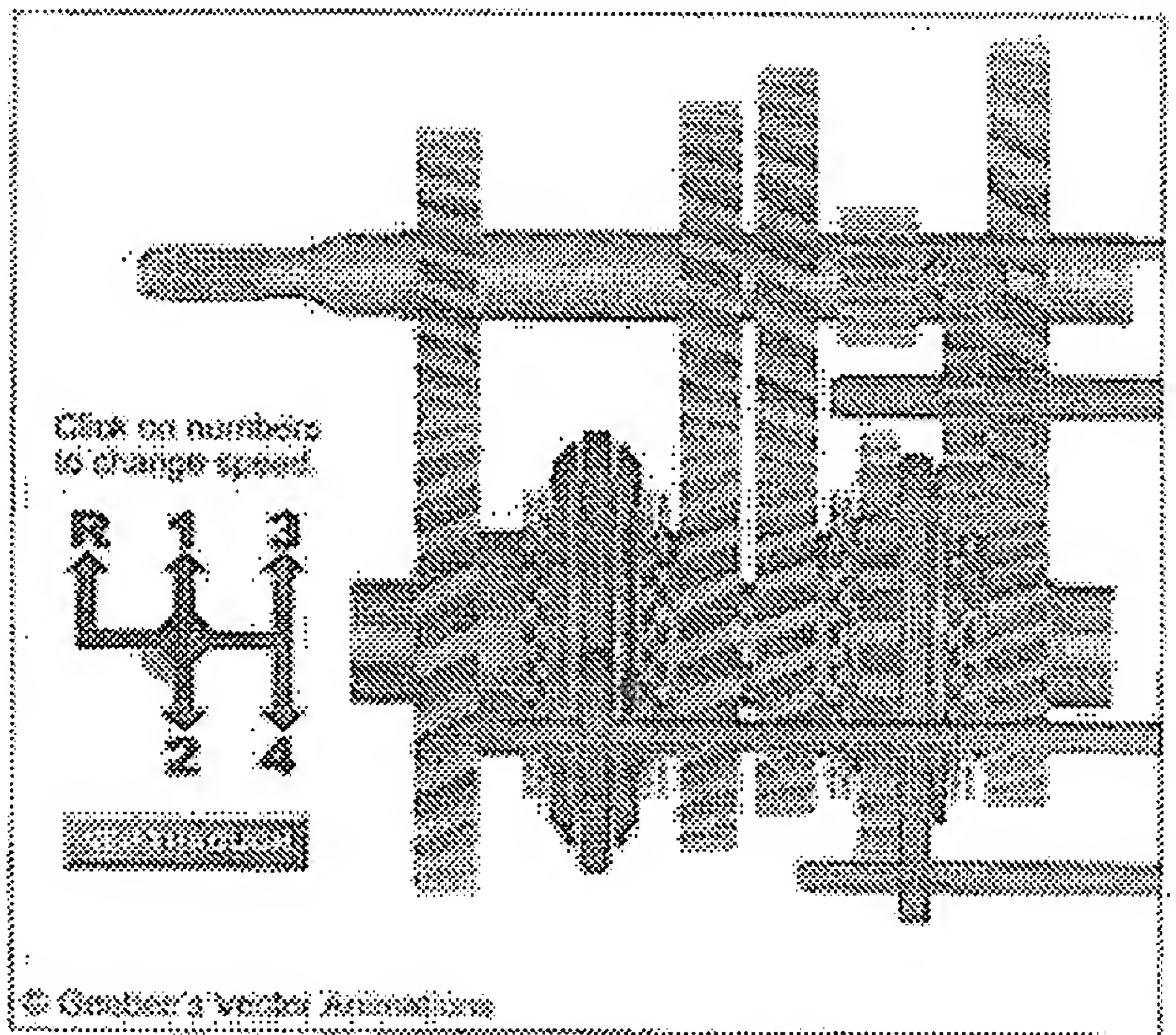
From this discussion, you can answer several questions:

- When you make a mistake while shifting and hear a horrible grinding sound, you are not hearing the sound of gear teeth mis-meshing. As you can see in these diagrams, all gear teeth are all fully meshed at all times. The grinding is the sound of the **dog teeth** trying unsuccessfully to engage the holes in the side of a blue gear.
- The transmission shown here does not have "synchros" (discussed later in the article), so if you were using this transmission you would have to **double-clutch** it. Double-clutching was common in older cars and is still common in some modern race cars. In double-clutching, you first push the clutch pedal in once to disengage the engine from the transmission. This takes the pressure off the dog teeth so you can move the collar into neutral. Then you release the clutch pedal and rev the engine to the "right speed." The right speed is the rpm value at which the engine should be running in the next gear. The idea is to get the blue gear of the next gear and the collar rotating at the same speed so that the dog teeth can engage. Then you push the clutch pedal in again and lock the collar into the new gear. At every gear change you have to press and release the clutch twice, hence the name "double-clutching."
- You can also see how a small linear motion in the gear shift knob allows you to change gears. The gear shift knob moves a rod connected to the fork. The fork slides the collar on the yellow shaft to engage one of two gears.

In the next section, we'll take a look at a real transmission.

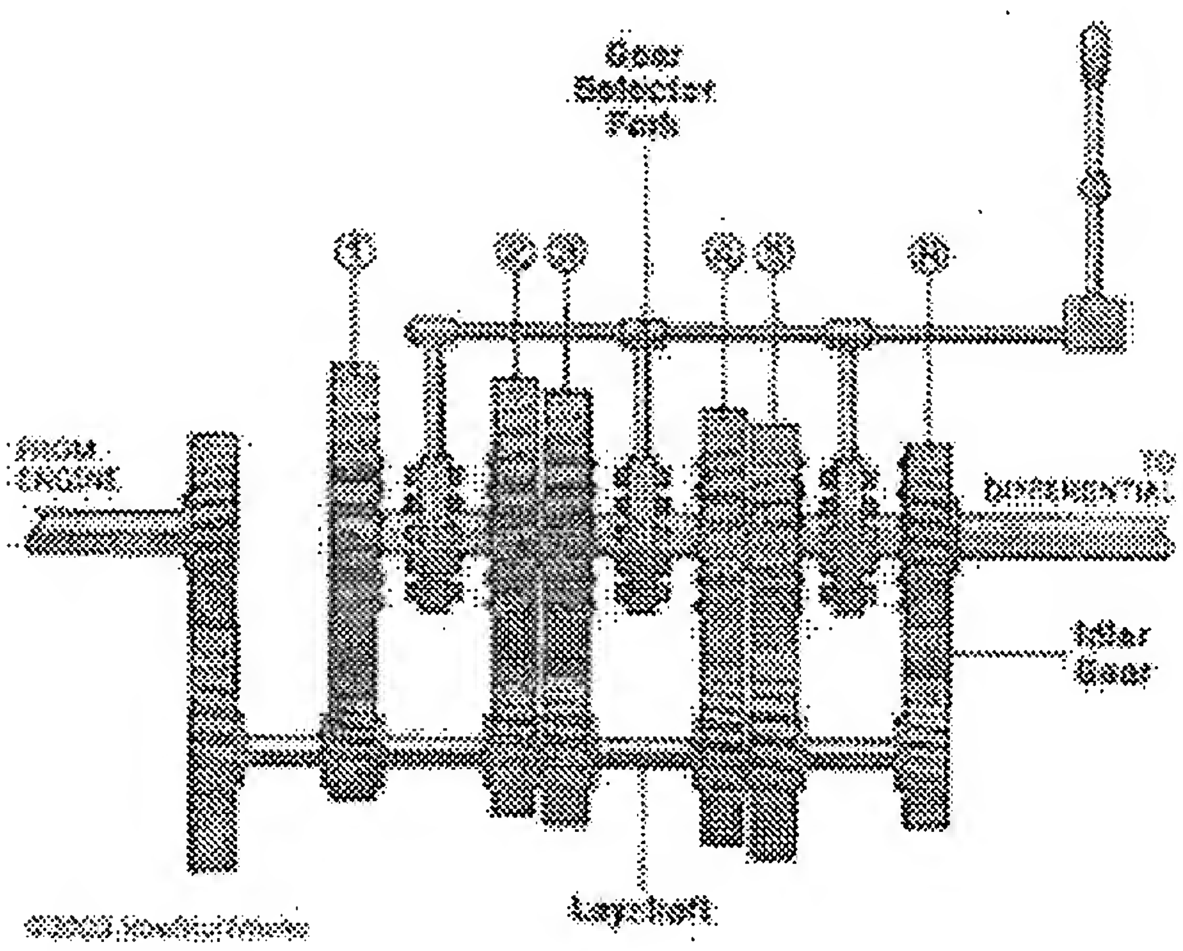
A Real Transmission

The following animation shows you the internal workings of a four-speed transmission with reverse.

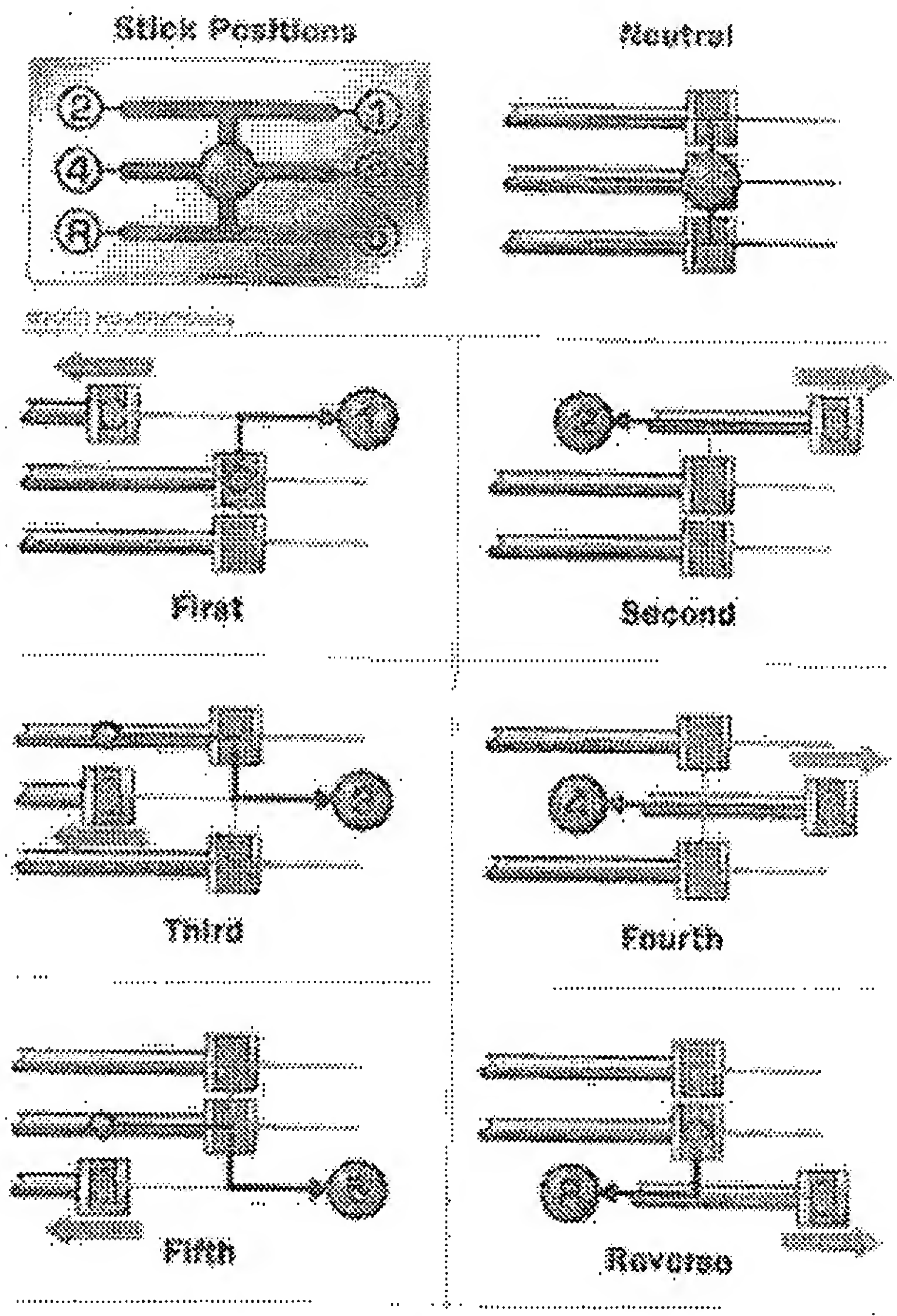


Animation courtesy Gerbe's Vector Animations

The **five-speed manual transmission** is fairly standard on cars today. Internally, it looks something like this.

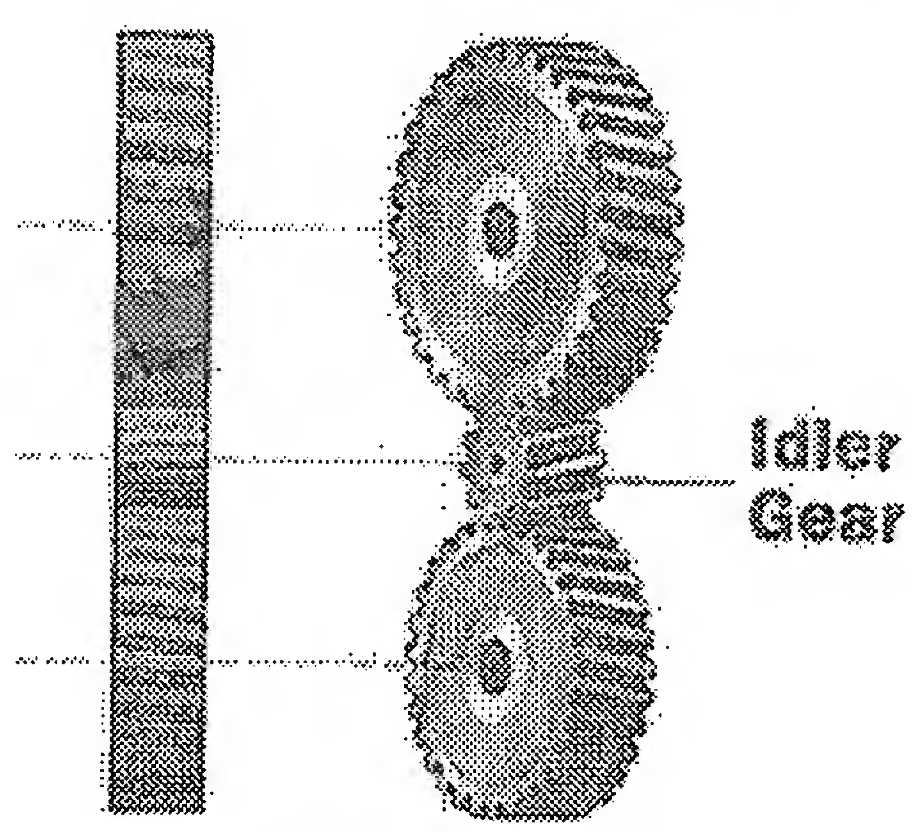


There are three forks controlled by three rods that are engaged by the shift lever. Looking at the **shift rods** from the top, they look like this in reverse, first and second gear.



Keep in mind that the shift lever has a **rotation point** in the middle. When you push the knob forward to engage first gear, you are actually pulling the rod and fork for first gear back.

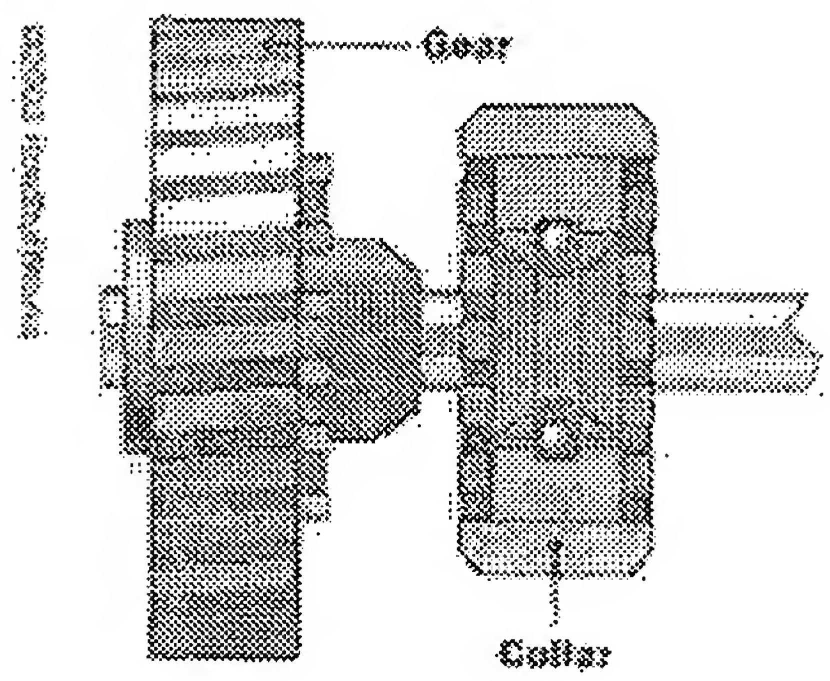
You can see that as you move the shifter **left and right** you are engaging different forks (and therefore different collars). Moving the knob **forward and backward** moves the collar to engage one of the gears.

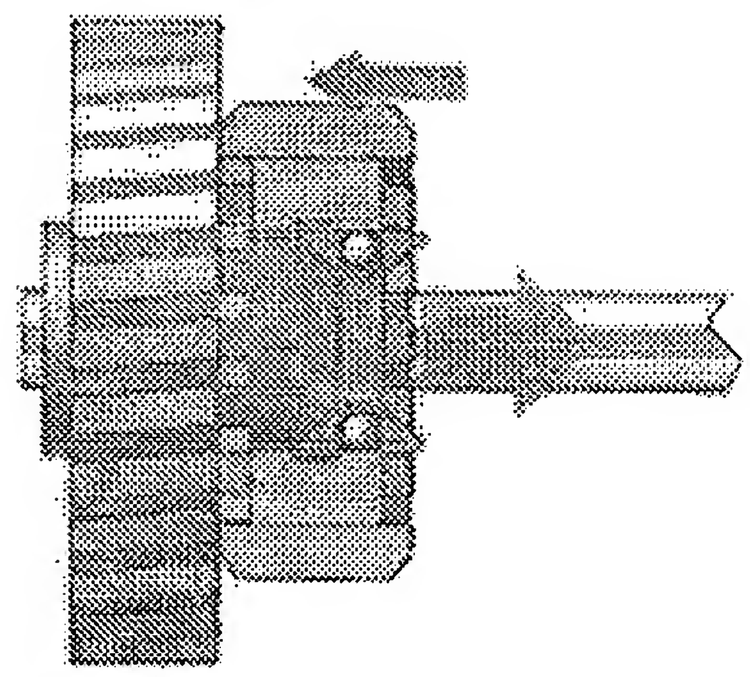


Reverse gear is handled by a small idler gear (purple). At all times, the blue reverse gear in this diagram is turning in a direction opposite to all of the other blue gears. Therefore, it would be impossible to throw the transmission into reverse while the car is moving forward -- the dog teeth would never engage. However, they will make a lot of noise!

Synchronizers

Manual transmissions in modern passenger cars use **synchronizers** to eliminate the need for double-clutching. A synchro's purpose is to allow the collar and the gear to make frictional contact before the dog teeth make contact. This lets the collar and the gear synchronize their speeds before the teeth need to engage, like this:





The cone on the blue gear fits into the cone-shaped area in the collar, and friction between the cone and the collar synchronize the collar and the gear. The outer portion of the collar then slides so that the dog teeth can engage the gear.

Every manufacturer implements transmissions and synchros in different ways, but this is the general idea.

For more information on transmissions and related topics, check out the links on the next page.

Lots More Information

Related HowStuffWorks Articles

- How Clutches Work
- How Gears Work
- How Automatic Transmissions Work
- How Car Cooling Systems Work
- How Torque Converters Work

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- Jeep Transmissions
- Reading Gear Ratios - determining speed potential
- Genesis of a champion - Autocross
- 3 Million to 1 Microtransmission